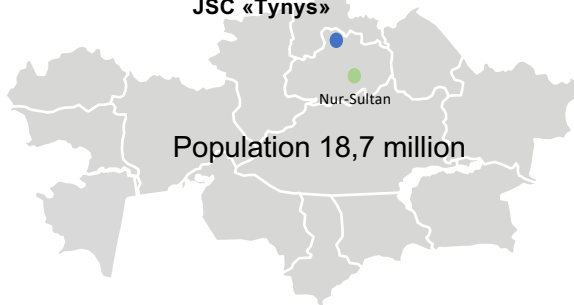


Mechanical ventilator manufacturing in Kazakhstan on the basis of existing production

Potential local partner:
JSC «Tynys»



Market size:

Current ventilators import is about USD 25 million per year according to official sources. Demand for 2020 is at least 1,000 ventilators. Strong export potential to neighboring countries in Eurasian Economic Union and Central Asia. Government provides an offtake contract.

| | USD mln | |
|-----------------|---------|------|
| Current imports | 2018 | 2019 |
| Total | 28,4 | 23 |
| Germany | 9,5 | 4,6 |
| Switzerland | 8,3 | 8,9 |
| China | 1,9 | 2,4 |
| England | 1,8 | 2 |
| USA | 1,8 | 1,7 |
| Others | 5,1 | 3,4 |

Component part's localization and alternative sites for production and service center:

There are several existing production facilities that have the required competence in production and localization of certain components for ventilators manufacturing: rubber products, sanitized rooms, laboratories and testing sites are used in aerospace industry, powerful 3D printers (polymers, steel, titan, aluminum), the manufacturing of 20-layer PCBs, medical equipment, and other electronic components.

Technical requirements:

Detailed technical requirements are presented in the appendix.

Local partner provides ready production site, acquires equipment, technical documentation and CAPEX, as well as initial operational expenses (OPEX).

Strategic investment partner will be responsible for the production technology, technological documents, an engineering team, and local personnel education.

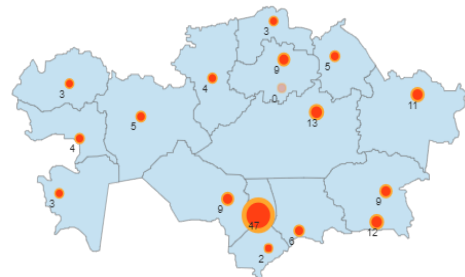
Also, establishment of service center and component part's localization at alternative facilities are required.

Production capacity:

Existing ventilator production capacity is available on the basis national company JSC "Tynys" (<https://tynys.info/en/ao-tynys/>).

Healthcare indicators:

The number of hospital beds ~100 thousand
The number of healthcare organizations: 145



«Plant n.a. S.M. Kirov» JSC (Petropavlovsk) - manufacturing of communication tools, electronics.

«Kazakhstan Aselsan Engineering» LLP (Nur-Sultan) – manufacturing of PSB, optics, testing laboratories.

«Galam» LLP (Nur-Sultan) – it specializes in space technology, has modern facilities, "clean" rooms, a 3D printer, laboratory and testing capabilities;

«Delta-IT» JSC (Almaty) – it specialized in the production of communications, has modern equipment for the production of circuit boards;

«Kazmedpribor» LLP (Shymkent) - manufacturer of medical equipment, has a European certificate of quality.

«HIMAX» LLP (Pavlodar) – the production of plastic medical products. It has a fleet of modern injection machines that allow thin-walled products to be cast, as well as a line for individual packaging and a line for sterilization with ethylene oxide.

«Clever Medical» LLP (Almaty) – it produces medical angiographic sets, planned to establish the production of catheters. Has certification of premises.

«JULDYZ KENAN Co.,LTD» LLP (Almaty) – produces single-use medical devices (catheters, hoses, etc.).

Specifications for ventilators required by the Ministry of Health of the Republic of Kazakhstan

| 1 | General characteristics: | Comments: |
|-----|--|---|
| 1.2 | The device is designed for continuous controlled artificial ventilation of the lungs in adults and children in a hospital. | Required |
| 2 | Specifications: | |
| 2.1 | type of drive | pneumatic from compressor and / or turbine |
| 2.2 | Power supply | 100 to 240 VAC \pm 10%, 50/60 Ghz |
| 2.3 | Battery operation | not less than 60 min |
| 3 | Gas Requirements: | |
| 3.1 | Gas supply | The device requires an oxygen connection, while air is supplied through the turbine |
| 3.2 | Gas supply (oxygen / air), in the range: | |
| 3.3 | Minimum value | not above 2,8 bar |
| 3.4 | Maximum value | not less than 6 bar |
| 3.5 | Inspiratory flow rate control mechanism | automatic |
| 4 | Display: | |
| 4.1 | Display dimension | not less than 12" |
| 4.2 | Touch screen function | Required |
| 4.3 | Control should be carried out both using the touch screen and using the rotary-push device (encoder), as well as using additional functional quick access buttons. | Required |
| 4.5 | Russian interface | Required |
| 5 | Monitoring requirements: | |
| 5.1 | The device should be equipped with intelligent monitoring with graphic visualization of the main indicators that reflect in real time the ventilation process, the state of respiratory mechanics. | Required |
| 5.2 | Visual display of the state of pulmonary mechanics in the form of an image of a picture of the lungs. The image (shape) of the lungs should change with a change in lung compliance or airway resistance in real time, as well as with the appearance of spontaneous breaths in the patient. | Required |
| 5.3 | The function of visual graphic display of the degree of readiness of the patient for excommunication from ALV. | Required |

| | | |
|-------------|---|----------|
| 6 | ALV Modes and Methods: | |
| 6.1 | Volume controlled (VC) | Required |
| 6.2 | Pressure controlled (PC) | Required |
| 6.3 | Pressure supported (PS) | Required |
| 6.4 | Ventilation with "release" of airway pressure. | Required |
| 6.5 | Non-invasive ventilation | Required |
| 6.6 | High Flow O2 mode, high air-oxygen mixture flow | Required |
| 7 | Special ventilation modes and functions: | |
| 7.1 | Ventilation with two-phase positive airway pressure | Required |
| 7.2 | Ventilation with "release" of airway pressure | Required |
| 7.3 | Intelligent ventilation mode with passive and spontaneous breathing for adult patients and pediatric patients. Automatic ventilation control based on respiratory activity and mechanics and lung protection strategies | Required |
| 7.4 | Regeneration of the tracheobronchial tree with oxygenation of 100% oxygen. | Required |
| 7.5 | Automatic backup ventilation in cases of apnea by pressure and volume | Required |
| 7.6 | Ability to select backup ventilation parameters | Required |
| 7.7 | Automatic return to support modes when recovering spontaneous breathing | Required |
| 7.8 | Function of automatic self-testing of the device before connecting with calibration of sensors | Required |
| 8.8 | Functionality Requirements: | |
| 8.1 | Leak compensation function | Required |
| 8.2 | Endotracheal / tracheostomy tube resistance compensation function | Required |
| 8.3 | Sanitation of the tracheobronchial tree | Required |
| 8.4 | Print screen function | Required |
| 8.5 | Built-in nebulizer or port for connecting a nebulizer | Required |
| 9 | Flow Measurement Requirements: | |
| 9.1 | Structurally, the apparatus should ensure the operation of the apparatus with an external (proximal to the patient) flow sensor, which should provide better synchronization with the patient, and higher measurement accuracy. | Required |
| 10 | Special Functions: | |
| 10.1 | Automatically proposed selection of initial ventilation parameters taking into account the ideal patient weight | Required |

| | | |
|-------|---|--|
| 10.2 | Automatically determine ideal weight when entering patient height and gender | Required |
| 10.3 | Retrofit with new options and software versions | Required |
| 11 | Ventilation Parameters: | |
| 11.1 | Tidal volume | |
| 11.2 | Minimal volume | Not more than 20 ml |
| 11.3 | Maximum value | Not less than 2000 ml |
| 11.4 | Breathing rate | |
| 11.5 | Minimal volume | Not more 1 breath/min. |
| 11.6 | Maximum value | Not less than 120 breath/min. |
| 11.7 | Maximum Inspiratory Flow | Не менее: 150 l/min |
| 11.8 | PEEP / CPAP | от 0 до 45 cmH2O |
| 11.9 | Sensitivity Streaming Trigger Range | 0.5 - 15 l/min |
| 12 | Patient Monitoring: | |
| 12.1 | The curves | Not less than 4 |
| 12.2 | hinges | Not less than 2 |
| 12.3 | Reference loop function | Required |
| 12.4 | Trends | trend data for at least 3 days for the selected parameter or combination of parameters |
| 12.5 | Developments | Not less than 1000 |
| 13 | Parameter monitoring: | |
| 13.1 | Pressure: | |
| 13.2 | Peak airway pressure: Ppeak (cmH2O) | Required |
| 13.3 | Plateau or end-inspiratory pressure: Pplateau (cmH2O) | Required |
| 13.4 | Mean airway pressure: Pmean (cmH2O) | Required |
| 13.6 | PEEP (positive pressure at the end of expiration) and CPAP (constant positive airway pressure): PEEP / CPAP (cmH2O) | Required |
| 13.6 | Speed: | |
| 13.7 | peak expiratory flow: Exp Flow (l/min) | Required |
| 13.8 | Maximum inspiratory rate: Insp Flow (l/min) | Required |
| 13.9 | Volume: | |
| 13.10 | Expiratory flow: VTE (ml) | Required |
| 13.11 | Respiratory flow: VTI (ml) | Required |
| 13.12 | Minute expiratory volume: ExpMinVol (l/min) | Required |
| 13.13 | Spontaneous minute expiratory volume: MVSpont (l/min) | Required |
| 13.14 | Leakage rate: VLeak (ml) или Vleak (%) или MVLeak (l/min) | Required |
| 13.15 | Time / frequency: | |
| 13.16 | Inhalation to Exhalation Ratio: I:E | Required |

| | | |
|-------|---|------------------------|
| 13.17 | Total respiratory rate: f_{Total} (b/min) | Required |
| 13.18 | Spontaneous respiration rate: f_{Spont} (b/min) | Required |
| 13.19 | Inspiratory time: TI (s) | Required |
| 13.21 | Lung mechanics: | |
| 13.20 | Static match: C_{stat} (ml/cmH ₂ O) | Required |
| 13.21 | Airway occlusion pressure: P0.1 (cmH ₂ O) | Required |
| 13.22 | Product time pressure: PTP (cmH ₂ O*s) | Required |
| 13.23 | Constant (constant) expiratory time: R_{Cexp} (s) | Required |
| 13.25 | Oxygen: | |
| 13.26 | The concentration of oxygen in the delivered gas | Required |
| 13.27 | CO ₂ : | |
| 13.28 | Fractional end-expiratory CO ₂ concentration: F_{etCO_2} (%) | Required |
| 13.29 | CO ₂ pressure at the end of exhalation: P_{etCO_2} (mmHg) | Required |
| 13.30 | CO ₂ elimination: $V'CO_2$ (ml/min) | Required |
| 14 | Alarms: | |
| 14.1 | 360° alarm light visibility | Required |
| 14.2 | Alarm Priorities | Not less than 3 levels |
| 15 | Humidifier and circuit requirements: | |
| 15.1 | The reusable circuit must be pre-assembled and ready for use. | Required |
| 15.2 | Heated circuit, all-in-one design | Required |
| 15.3 | Integrated temperature sensor | Required |
| 15.4 | Humidifier Warm Up Time | Not more than 30 min |
| 15.5 | The established parameters of temperature and humidity | Required |
| 16 | Equipment | |
| 16.1 | Base unit | Required |
| 16.2 | Mobile trolley with wheels (with brakes) | Required |
| 16.3 | Compressor | Required |
| 16.4 | High pressure hose for air | Required |
| 16.5 | High pressure hose for oxygen | Required |
| 16.6 | Reusable circuit for adults / children | Required |
| 16.7 | Circuit holder | Required |
| 16.8 | Streaming sensors (adult / child, at least 10 units) | Required |
| 16.9 | Expiratory valve assembly | Required |
| 16.10 | Oxygen sensor | Required |
| 16.11 | Humidifier | Required |
| 16.12 | Capnographic sensor with adapter | Required |
| 16.13 | A set of nasal cannulas for High-flow oxygen therapy (at least 3 sizes) | Required |